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GB 2187702 A GB 1199998 A US 4642239 A

(58) Field of Search
UK CL (Edition N) **B8C CWP3**
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(54) Package with modified atmosphere

(57) A food product package (1) comprises a product (such as a cut (5) of red meat on a tray (3)) enclosed within an envelope (7) of gas permeable film containing a modified atmosphere of an oxygen-rich mixture of oxygen and carbon dioxide. The envelope (7) is sealed at its ends (9 and 11) close to the ends of the food product and tray combination (3, 5). The film envelope (7) is then shrunk into contact with the meat and the tray.

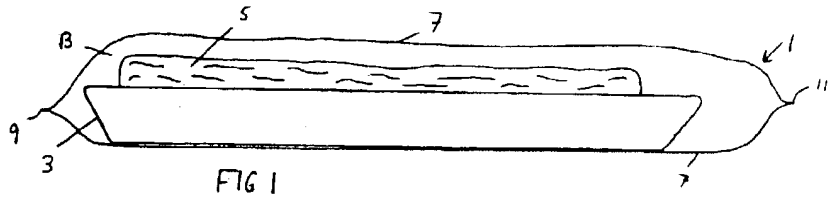

FIG 1

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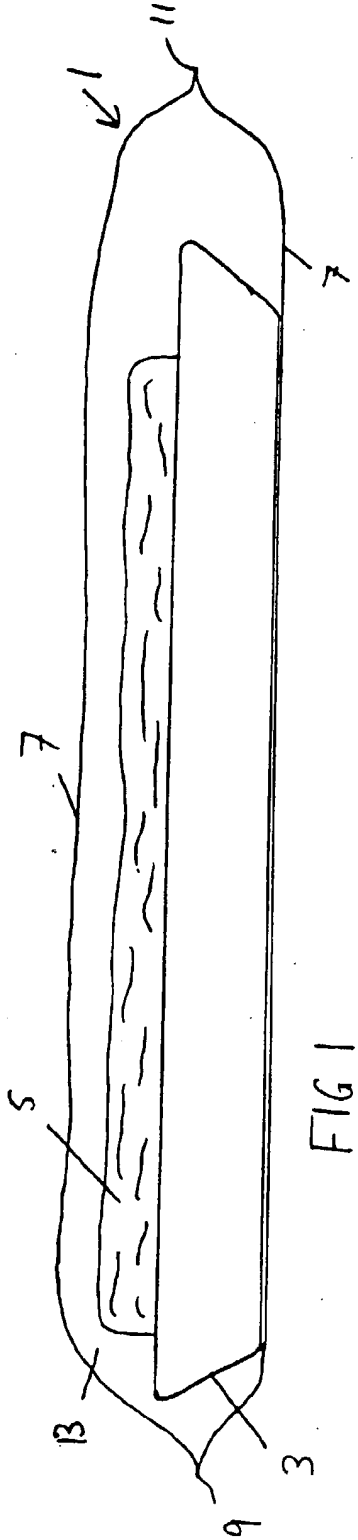


FIG 1

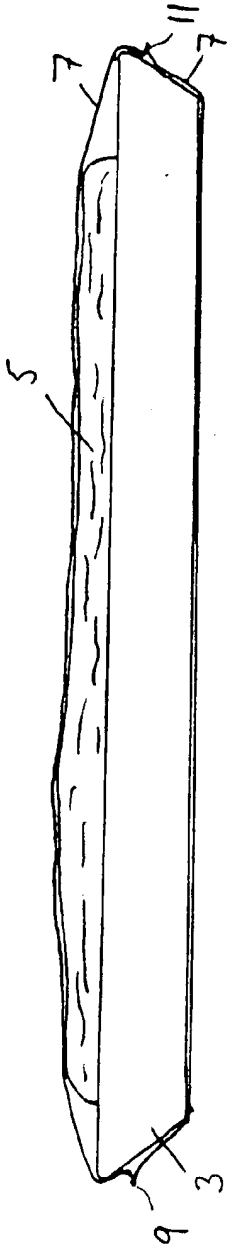
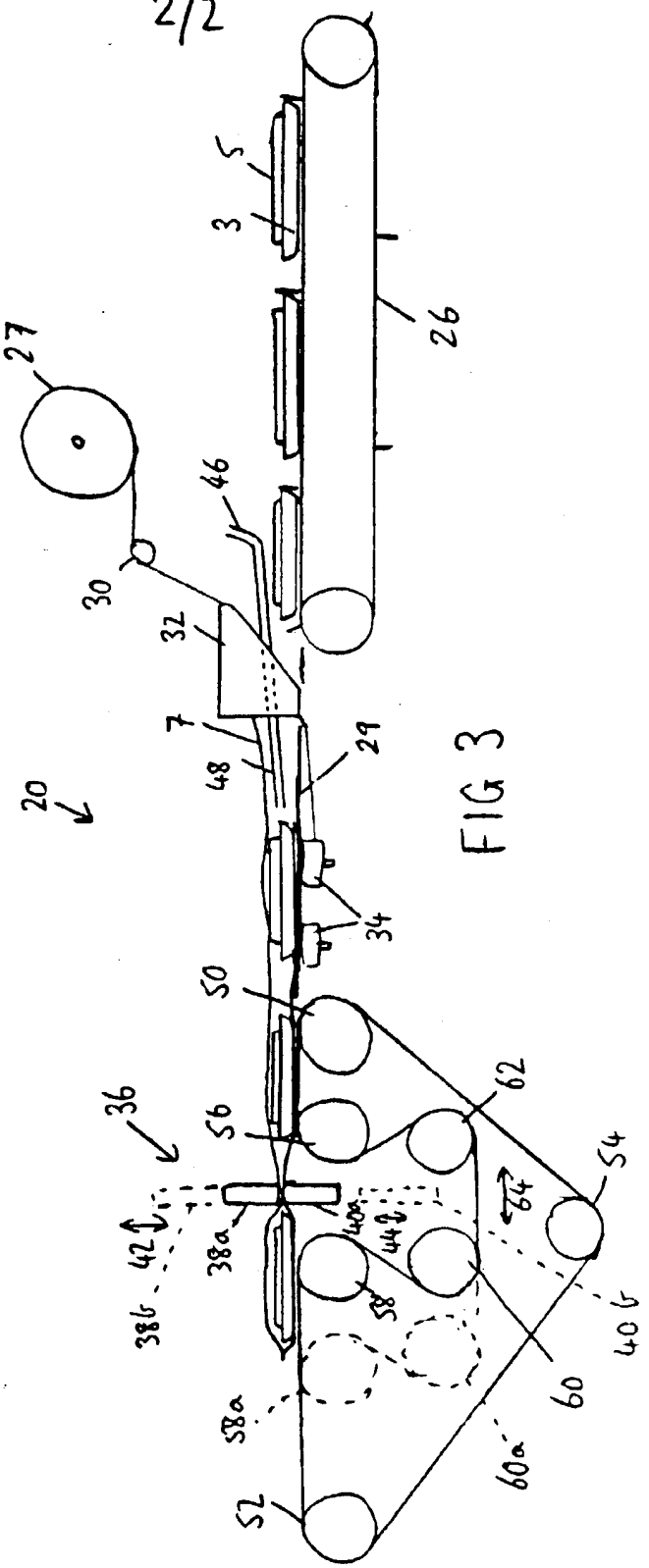


FIG 2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40b
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60a
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FIG 3

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PACKAGING

The present invention relates to a food package, in particular to a pack which is known to allow a food product to be displayed with minimum change in appearance and with resistance to bacterial activity during an extended shelf life in a display cabinet. One example of a product to be packed in this way is a cut of fresh red meat.

The invention also relates to a method of forming a food package.

In the past, fresh red meat has been stored by placing it in a gas permeable inner pack which is then stored within an outer envelope which is filled with a modified gas atmosphere, (i.e. gas-flushed to remove air and to introduce the modified atmosphere of, for example, O_2, N_2 or CO_2). The outer envelope is of a high gas barrier material so that one or more of the inner permeable packs may be stored in the high barrier outer envelope until display is required, and at that stage the outer envelope is opened and the or each pack within it is then placed in the display cabinet exposed to the atmosphere. Thereafter the permeability of the pack allows the atmosphere within the pack to exchange with the environment at a controlled rate during the shelf life of the product. Fresh red meat is known to retain its red colour for over a week when stored in a cool cabinet at temperatures of from 2°C to 6°C.

One example of a prior art specification disclosing such a double pack is US-A-5226531 (Garwood) in which the modified atmosphere within the pack is disclosed as being of O_2, N_2 or CO_2, or mixtures thereof. Until opening of the outer container by removal of the outer cover, no extensive migration of gas from within the inner pack under the inner lid is possible, but once the outer cover has been removed the gas permeable inner lid is communicated on its exterior to atmosphere and gas exchange can take place at a controlled rate between the interior and exterior of the pack bounded by the inner lid.

An alternative system for packaging of red meat using this twin pack concept is one in which cuts of meat, each overwrapped in a respective sheet of PVC film whose overlapping portions are caused to adhere to one another by the application of low temperature heat on a sealing plate (and which is therefore essentially an air-permeable film pack), are placed in a single outer container in the form of a bag of high gas barrier material filled with modified gas atmosphere which may include O_2, N_2 or CO_2, or any mixture thereof.

Surprisingly we have now found that, by forming a pack of a material which is less permeable to oxygen than the conventional polyvinyl chloride (PVC) overwrapped pack and filling that pack with a modified atmosphere by gas flushing, the shelf life can be extended by an appreciable period and no loss of shelf life is detected when the individual packs are stored in atmosphere rather than within the modified atmosphere of an outer barrier container.

Accordingly, one aspect of the present invention provides a method of packaging food products comprising enveloping the food product in a film which is not a gas-barrier and flushing air from between the food product and the film and replacing it with a modified atmosphere of oxygen-rich O_2/CO_2 mixture.

Preferably the pack is formed by introducing the food product into a tube of the film material and heat-sealing the ends of a cut section of tube enclosing the food product. More preferably the food product is placed on a tray when introduced into the tube of film.

The gas flushing operation may be carried out by a gas flushing lance extending into one end of the tube after the other end has already been sealed, to flush the air from within the open-ended tube and to introduce the modified atmosphere after which the second end of the film tube is sealed.

Although it is possible for one or several such packs to be stored within a gas barrier outer container filled with

modified atmosphere, it is particularly preferred for the gas permeable film of said pack to be in direct contact with atmospheric air without the need for such an outer barrier film.

A second aspect of the present invention provides a food pack comprising a food product enclosed within a sealed envelope of gas-permeable film, the space around the food product and within the envelope having been gas flushed to remove atmospheric air and to introduce a modified atmosphere of an oxygen-rich mixture of oxygen and carbon dioxide.

In order that the present invention may more readily be understood, the following description is given, merely by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a side elevational view of a pack in accordance with the present invention, after sealing;

Figure 2 is a side elevational view of the pack of Figure 1, after a subsequent shrinking operation to improve the appearance of the pack; and

Figure 3 is a side elevational view, in schematic form, showing an embodiment of apparatus for forming the pack in accordance with the invention.

Figure 1 shows the pack 1 as comprising a tray 3, (which may be of solid or foamed plastic, such as polypropylene, polyvinyl chloride or polystyrene), supporting a product 5 in the form of a cut of red meat, for example pork having generally pink colour. The combination of tray and pork meat is enclosed within a film envelope 7 in the form of a tube having its lefthand end sealed at 9 and its righthand end sealed at 11.

The space 13 within the film tube 7 and around the pork joint 5 is occupied by a modified atmosphere of an oxygen-rich mixture of oxygen (O_2) and carbon dioxide (CO_2). In the preferred case

the proportions are 75% by volume O_2 and 25% by volume of CO_2. Preferably the oxygen content may be at least 60%, and it is conceivable for it to be higher than 75%, for example 80% is one preferred choice.

As will be evident from Figure 3, the creation of a modified atmosphere conditions within the space 13 is preferably achieved by first hermetically sealing one end, of the film tube 7, say at seal 9, while leaving the other end (say seal 11) open and introducing a hollow gas flushing lance into the pack through the open end. The modified atmosphere gas is then discharged from the lance into the interior of the film tube 7 at a location well along the pack towards the end seal 9, and the rate of introduction of gas is such that all of the initially present air is expelled and the space is entirely occupied by the modified atmosphere. At this point there is relative separating movement between the tray and the lance, and the hermetic seal 11 is made so as to form the closed pack shown in Figure 1.

The pack shown in Figure 1 is subjected to the shrink-tidying operation, preferably by placing it in a shrink tunnel in which hot air is blown over the surface of the film. The heat exchange medium for the shrink operation may instead be steam, or equally the shrink-tidying operation may be effected by dipping the pack of Figure 1 into a bath of hot water.

If desired, the pack of Figure 2, or preferably a plurality of such packs, is placed into an outer oxygen-impermeable or barrier envelope such as a bag of barrier film, for example that marketed by W.R. Grace & Co.-Conn under the Registered Trade Mark Cryovac Barrier Bag. Again the interior of the bag is subjected to a gas-flushing operation similar to that described with reference to Figures 1 and 2, and the bag is sealed. Such an arrangement allows the bag to be transported from the butchering area to the point of sale, whereupon the outer bag is opened and the individual packs are put on display. While in the bag the various packs 1 will be in a condition in which atmospheric air is excluded because of the

barrier function of the bag material, but once they have been removed from the bag the individual packs 1 are subject to a condition in which there is an exchange of atmosphere between the modified atmosphere in the space 13 in the pack and the atmospheric air outside the pack. In practice, as a result of the shrinking operation, the pressure within the pack will be higher than atmospheric so the general migration of gas will be emigration of the modified atmosphere out through the film material 7.

Figure 3 shows an apparatus 20 as comprising an infeed belt conveyor 26 and an outfeed belt conveyor 28 to define a path for the trays 3 and products 5. The packaging film 7 from supply roll 27 passes over a deflector roll 30, and then descends over a forming shoe 32 where the flat film 7 is converted into a tube whose seam is underneath and is sealed by heated film sealing nip rolls 34 rotating about vertical axes and pinching between them the edges of the film web 7 to seal them together by virtue of the action of heat applied conductively by means of the rolls 34. The rolls 34 are positioned to either side of a longitudinal slit in a product support plate 29 along which the trays 3 in the tube of film slide.

The thus formed tube then passes leftwardly to a sealing station 36 where a reciprocating upper sealing bar moves between a lowered or advanced sealing position 38a and a raised or retracted position 38b and a vertically reciprocating lower sealing bar moves between an upper or advanced position 40a and a lower or retracted position 40b. The vertical movements of the upper and lower sealing bars are represented by the arrows 42 and 44, respectively, and the retracted positions are in each case shown in dotted line form.

Flushing gas is introduced continuously into the tube of film material 7 by way of an infeed pipe 46 and passes into a flushing lance 48 which passes through the film forming shoe 32 and terminates well to the lefthand side of the film-forming shoe 32 so as to ensure that the modified atmosphere gas is

released close to the location of the sealing station 36 and hence achieves the expulsion of substantially all of the residual air within the tube and around the individual tray/product combinations 3-5 passing along the support plate 29.

In operation, a continuous supply of tray/product combinations 3-5 enters the infeed conveyor 26 and passes leftwardly through the forming shoe 32 around which the film web is passing so as to form the tube (by means of the sealing rolls 34) from which any residual gas is flushed by the flushing lance 48.

The movement of the film tube at the point of sealing at the sealing station 36 is permitted by virtue of the fact that the outfeed conveyor belt is mounted on stationary axis rollers 50, 52 and 54 and on horizontally moving rollers 56, 58, 60 and 62 whose movement is represented by the arrows 64. The upper and lower sealing bars also move horizontally in synchronism with the rollers 56, 58, 60 and 62. The leftmost position of the rollers 58 and 60 is shown at 58a and 60a in Figure 3.

The sealing station 36 thus operates in a manner which allows the film tube to be in continuous leftward movement (by virtue of simultaneous circulation of the upper and lower sealing bars around respective rectangular paths to accommodate the leftward movement at the point of sealing when they are in their advanced positions 38a and 40a respectively and rightward movement when in their retracted positions 38b and 40b respectively).

Sealing of the trailing end of the just finished pack occurs simultaneously with closing the leading end of the tube of sealing film 7.

Comparative tests were carried out on (i) the packs of Figures 1 and 2 and (ii) PVC overwrapped packs (in which a sheet of PVC is wrapped around the product about the longitudinal axis of the tray and then caused to seal against itself by pressing the

underside of the tray against a low temperature heating plate following which the loose surplus PVC film material at each end of the pack is tucked under and again sealed using the low heat sealing plate). In these tests the PVC overwrapped packages formed in air, and hence containing air between the product and the PVC film, were placed within an outer barrier bag which was gas-flushed with a 75/25% oxygen-rich mixture of O_2/CO_2 and gave a shelf life of 8 to 9 days. Using the same modified atmosphere and the same meat cuts, the pack of Figures 1 and 2 gave a shelf life of a sirloin steak in the pack of the order of 9 days, measured in terms of retention of meat colour. It was also found that well into the shelf life the total viable count (TVC) of bacteria is lower with the pack of Figures 1 and 2 than with the non-flushed overwrapped PVC pack.

For the purposes of this comparison test, the PVC overwrapped packs were kept in cold store conditions in their outer bag for 2 to 4 days and then removed, some on the second day, some on the third day, and some of the fourth day, and placed on display in a refrigerated cabinet at between 2 and 3°C.

The packs with the modified atmosphere within the shrunk sealed tube were stored in air in cold store for two days and then put on immediate display. Between 8 and 10 days from the date of packaging the coloration of the beef in the PVC overwrapped packs became such that they were considered no longer saleable. The same change occurred in the packs of Figures 1 and 2 at between 8 and 10 days from packaging without the use of an outer bag containing modified atmosphere.

In this test the meat was sirloin steak having a thickness of 15 to 20 millimetres as steaks cut from several strip sirloins which had then matured for six days in vacuum bags available from the Cryovac Division of Grace.

The gas mixture in the individual packs was 80% O_2 and 20% CO_2, by volume, and where (in the case of the PVC overwrapped comparison bags) an outer bag was used, the gas atmosphere in that bag was 65% O_2 and 20% CO_2 by volume. The trays used for

the packs of both types were type 2M foamed polystyrene trays available from Linpac Ltd, and having a depth of 16 millimetres at the rim. The PVC film used for the comparison test was a 15μm thick single layer of film whereas the film for the packs of Figures 1 and 2 were of a 15 to 19μm thick 3 ply film whose facing layers (both inside and outside the pack) were of a blend of ethylene vinyl acetate (EVA), linear medium density polyethylene and linear low density polyethylene, and the intervening layer was of linear low density polyethylene with antifogging agents present. Such a film is disclosed in US-A-4551380.

By virtue of an irradiation dosage of 7 Megarads in the case of the film used for the packs of Figures 1 and 2, the film used for the packs of Figures 1 and 2 was capable of withstanding the levels of heat and pressure of the sealing bars required to seal the ends of the tube so as to obtain gas-tight seals by the HFFS (horizontal-foam-fill-seal) process illustrated in Figure 3. In practice the seals occur very close to the ends of the tray 3 in Figure 1, so that much less film is used in the case of the packs of Figures 1 and 2 than in the case of the comparison overwrapped PVC film packs, and moreover the seal is much more gas-tight and drip-proof in the case of the pack of Figures 1 and 2, where a hot bar seal is formed, than in the case of the comparison PVC overwrapped packs where the film simply adheres to itself by virtue of mild application of heat and only low pressure.

One possible explanation for the improved shelf life of the packs of Figures 1 and 2 may be that the seal is more gastight and consequently the overall gas permeability of the pack is less than in the case of the PVC overwrapped packs. As a result the CO_2 in the modified atmosphere stays in contact with the meat for longer in the early stages of the storing and consequently the bacteriostatic effects are better.

In spite of the high gas permeabilities of the film used in the modified atmosphere pack, for some unknown reasons they behave similarly to barrier films. This may be because the gas

exchange across the film might be not so rapid as expected or there may be an absorption of the modified atmosphere by the packaged food that then releases the absorbed gases more slowly.

The films themselves may have different gas permeabilities in that the film used for the packs of Figures 1 and 2 has an oxygen permeability of up to 15000 cc $O_2/m^2/bar/24hr$ at 23°C and 0% relative humidity (RH), preferably between 6000 and 12000 cc $O_2/m^2/bar/24hr$ at 23°C and 0% RH whereas the PVC film has a permeability of from 14000 to 15000 cc $O_2/m^2/bar/24hr$ at 23°C and 0% RH. These conditions of measurement are set out in ASTM D-3985.

The sealing temperature of the sealing bars used on the packs of Figures 1 and 2 is of the order of 200°C whereas the temperature of the hot plate against which the overwrapped PVC film is placed for adhesion purposes is of the order of 70°C.

Although, as indicated above, the modified atmosphere used may be O_2, N_2, CO_2 or any acceptable mixture thereof, in practice the choice of the modified atmosphere depends upon the nature of the meat. For cooked poultry it is desirable to avoid the presence of O_2 but to use a mixture of N_2 and CO_2, whereas for red meat the presence of O_2 helps to maintain the colour and the presence of CO_2 lowers bacterial activity.

C L A I M S

1. A method of packaging food products comprising enveloping the food product in a film which is not a gas-barrier and flushing air from between the food product and the film and replacing it with a modified atmosphere of oxygen-rich O_2/CO_2 mixture.

2. A method according to claim 1, wherein the exterior of said pack is in direct contact with atmosphere.

3. A method according to either of the preceding claims, wherein the food product is standing on a tray within the envelope.

4. A method according to any one of the preceding claims, wherein the envelope is formed as a tube which is just large enough in cross-section to receive the food product, and the length is just in excess of the inserted goods; and wherein the ends of the tube are heat-sealed by welding bars.

5. A method according to any one of the preceding claims, wherein the film used for the envelope has an oxygen permeability of up to 15000 cc $O_2/m^2/bar/24hr$ at 23°C and 0% relative humidity.

6. A method according to claim 5, wherein the oxygen permeability is from 6000 to 12000 cc $O_2/m^2/bar/24hr$ at 23°C and 0% relative humidity.

7. A method according to any one of the preceding claims, wherein the percentage of oxygen present in the modified atmosphere is at least 60% by volume.

8. A method according to claim 7, wherein the oxygen content is over 70% by volume, preferably 80% by volume.

9. A method according to any one of the preceding claims,

Patents Act 1977 12
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9500566.6

Relevant Technical Fields

(i) UK Cl (Ed.N) B8C (CWP3)

(ii) Int Cl (Ed.6) B65D 81/20

Search Examiner
STEPHEN SMITH

Date of completion of Search
10 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant following a search in respect of Claims :-
1 to 18

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application

&: Member of the same patent family; corresponding document

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2187702 A	(IVES) see lines 81 to 88 of page 1	12
X	GB 1199998	(UNILEVER) see lines 81 to 96 of page 3 and lines 3 to 31 of page 4	1, 7, 8, 9 12
X	US 4642239	(FERRAR) see lines 18 to 28 of column 6 and lines 59 to 68 of column 8	1, 2, 5, 7 8, 9, 10 12, 14, 17

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).